TECHNICAL DESCRIPTION

DMP
Position Finder

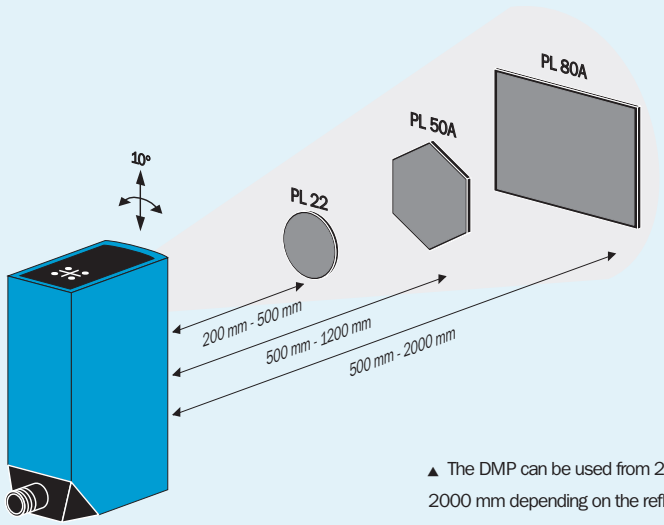
SICK

Overview

The DMP Position Finder is an opto-electronic sensor designed for use in the storage and materials handling industry, where accurate positioning of components is required. Constantly changing parameters caused by load, ambient temperature and steel stresses make accurate positioning almost impossible.

The DMP Position Finder was developed to eliminate these problems. It is used for precise positioning in the X and Y-axes. The device operates with a fixed reflector and therefore operates to actual site conditions, enabling reliable and accurate storage, retrieval and docking operations.

The device is designed so that only rough positioning is required in the catchment area (visible area) of the DMP.



▲ The DMP can be used from 200 mm to 2000 mm depending on the reflector type.

Application Areas

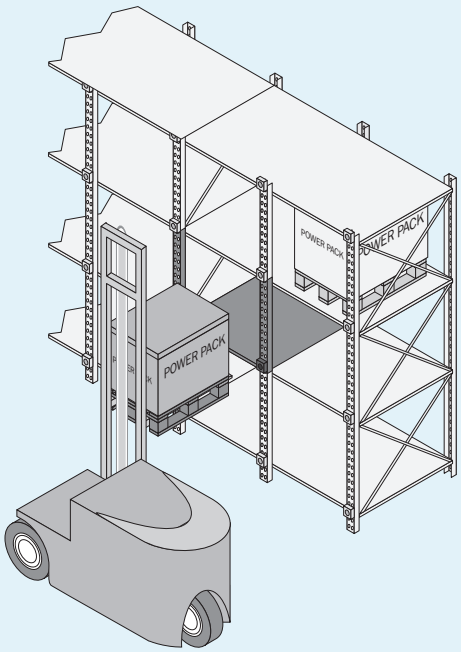
The DMP is designed for applications where accurate positioning for load transfer is important.

- For precise positioning of storage and retrieval units in high-bay warehouses
- For automatic rail installation machines
- For positioning of car elevators in automated car parks
- For transfer stations between static and mobile handling transport systems
- For automated truck unloading systems in goods distribution centers
- For docking driverless transport systems
- Many other applications

Advantages

- Direct movement into position using a fixed reflector as a reference

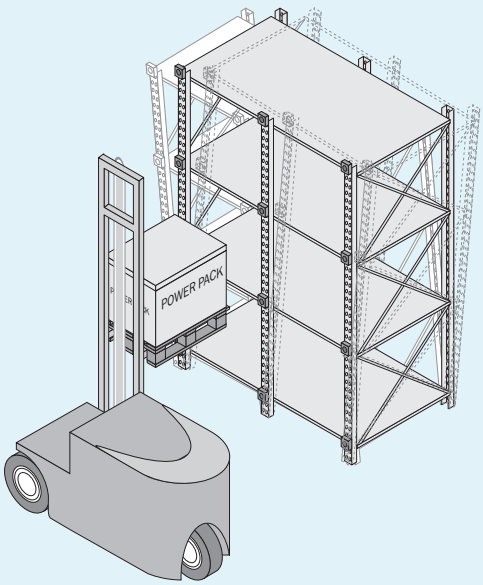
Advantage 1



◄ When the DMP is used, a reflector is fixed on each bin and reflects the light emitted by the DMP. The DMP evaluates this reflected light. The reflectors are fixed reference points, which make reliable positioning possible even when the ambient conditions change.

- Compensation for tolerances in steel construction allow accurate positioning

Advantage 2



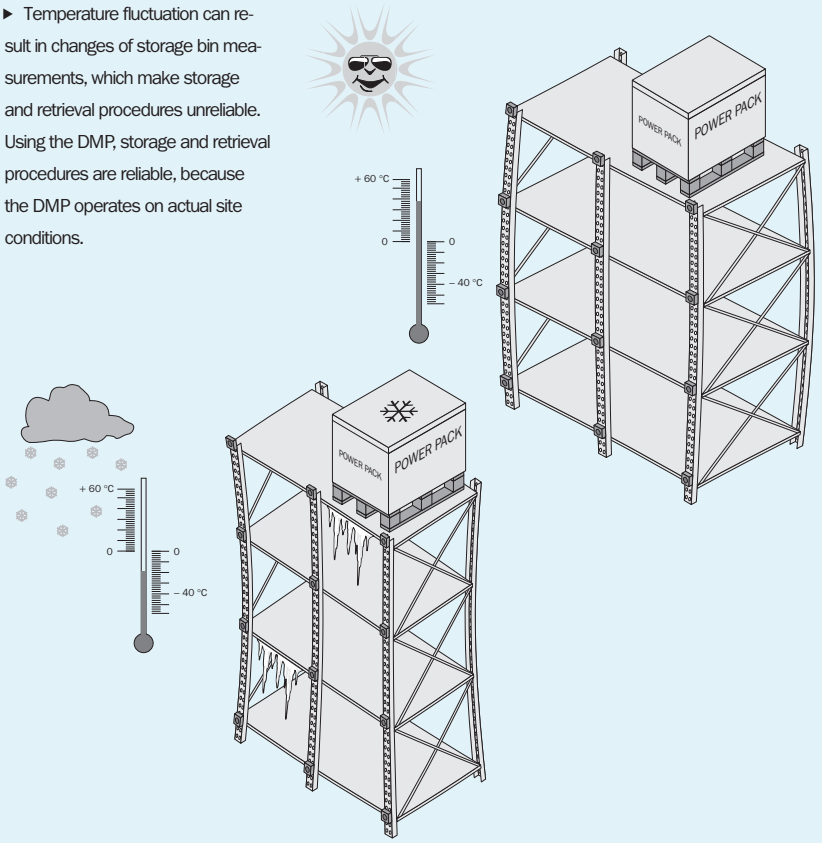
▲ In high-bay storage bins, there can be tolerance-dependent storage measurements due to uneven warehouse floors in addition to material-dependent tolerances in the construction. These tolerances do not influence the accuracy of the DMP.

Advantages

- **Temperature-dependent tolerances do not have any influence on the positioning accuracy**

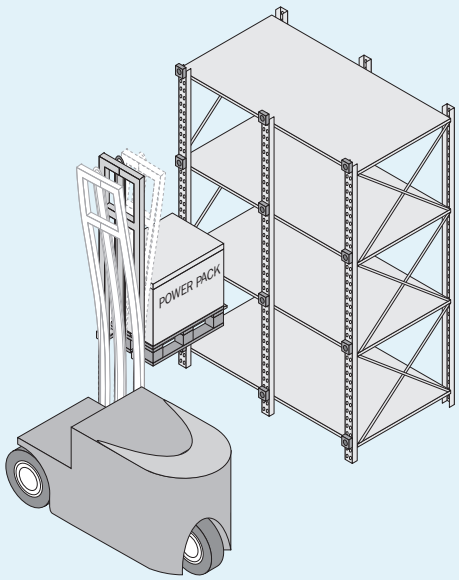
Advantage 3

▶ Temperature fluctuation can result in changes of storage bin measurements, which make storage and retrieval procedures unreliable. Using the DMP, storage and retrieval procedures are reliable, because the DMP operates on actual site conditions.



- **Compensation is made for inconsistencies in the travel of the storage and retrieval unit caused by acceleration and deceleration**

Advantage 4

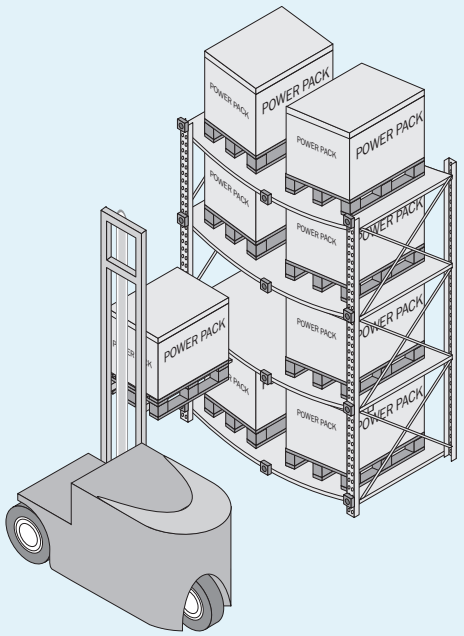


◀ Inconsistencies in movement and travel of the storage and retrieval unit must be considered, if accurate positioning is to be achieved.

Advantages

- Changing location measurements caused by weight are compensated for

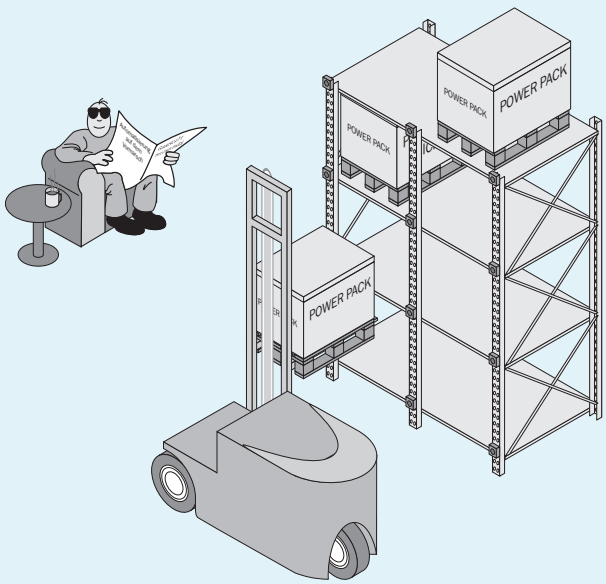
Advantage 5



▲ Differing location measurements caused by weight do not affect the accurate positioning procedure when the DMP is used.
The DMP makes optimum bin construction possible in terms of both space and material.

- The DMP provides the possibility of increased automation

Advantage 6



▶ The DMP enables precise coordination with the bins even with constantly changing ambient conditions and consequently enables the use of automatic storage and retrieval procedures.

Applications

High-bay warehouses/ Storage and retrieval units

Storage and retrieval units are used in high-bay warehouses for completely automatic storing and retrieving of pallets and other objects. The retrieval unit is roughly positioned in the target area by its central control unit. A SICK distance measuring device DME 3000 could be used for this procedure. The pre-positioning procedure should position the retrieval unit within the catchment area of the DMP. This catchment area measures 105 mm x 105 mm at a range of 300 mm.

Once the storage and retrieval unit reaches the catchment area the DMP takes control of the drives for final accurate positioning. The DMP completes the final positioning procedure of the retrieval unit and remains unaffected by changing site conditions.

Automated truck unloading

For automatic truck unloading at unloading ramps, the vehicles are positioned at the ramps and then the unloading procedure can begin. A reflector must be mounted on each truck. The light reflected by the reflector is then used to position the unloading unit. The unloading unit moves along the unloading ramp until the DMP detects the reflector on the side wall of the truck.

As soon as the reflector is in the catchment area of the DMP, the DMP controls the horizontal and vertical drives for precise positioning of the conveyor unit.

When the final, correct position is reached, the unloading procedure can be started.

The unloaded goods are stored intermediately in a high-bay storage area across from the unloading ramp. A second DMP is used here for the precise positioning of the storage and retrieval unit at the target bin (see High-bay warehouses/Storage and retrieval units).

Automated parking systems

Automated parking systems are to make best use of the available space. The central control unit positions the car elevator roughly in the catchment area of the DMP.

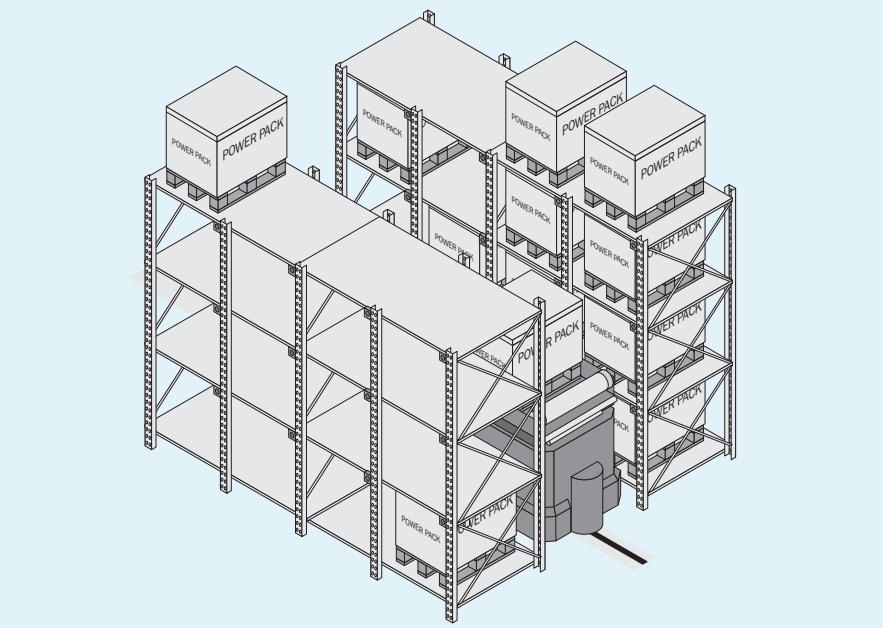
After the rough positioning, the DMP controls precise positioning by steering drives for the horizontal and vertical precise positioning of the elevator. When the final, correct position is reached, the slide-in rack can be pushed in with the car safely as a perfect fit.

This positioning possibility in a dynamic system makes it possible to construct parking systems optimally with respect to costs and material.

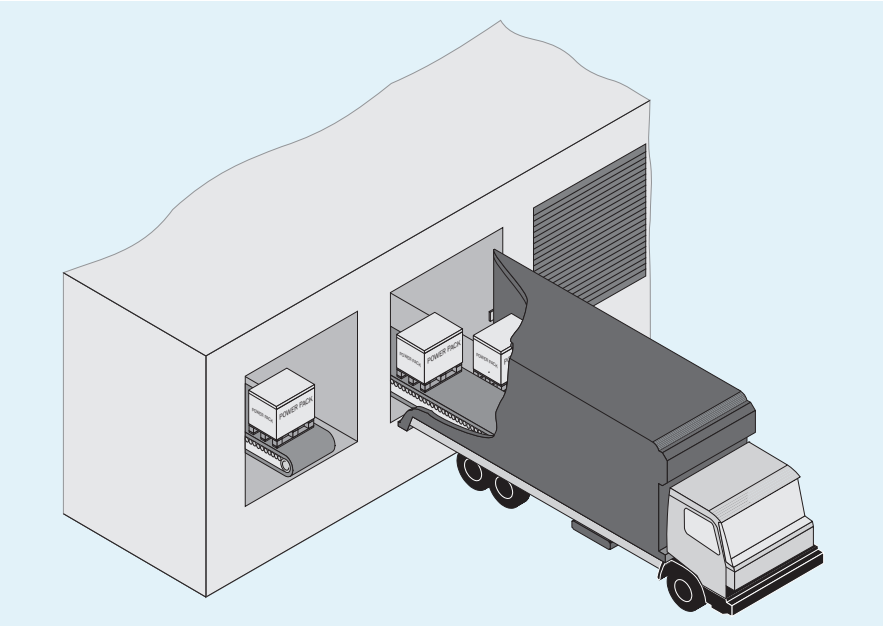
Temperature-dependent and weight-dependent tolerances do not have any influence on the positioning accuracy.

Applications

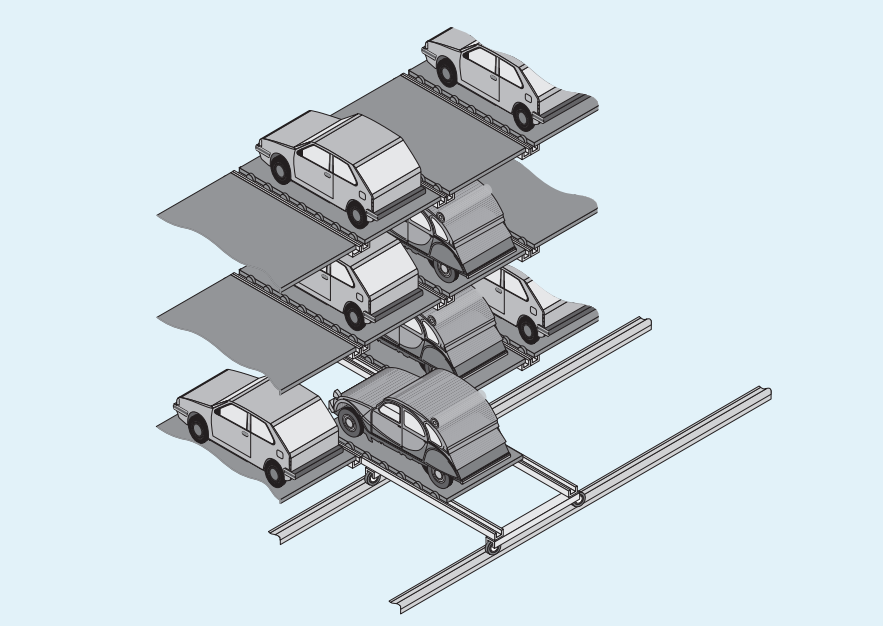
- High-bay warehouses/
  Storage and retrieval units



- Automated truck unloading



- Automated parking systems



Features

- Range 200 mm – 2000 mm (dependent on the reflector)
  - Reflector PL 22 200 mm – 500 mm
  - Reflector PL 50A 500 mm – 1200 mm
  - Reflector PL 80A 500 mm – 2000 mm
- Two-dimensional reception array
- Integrated software
- Simple operation
- Insensitive to ambient light
- Simple mounting
- Simple alignment

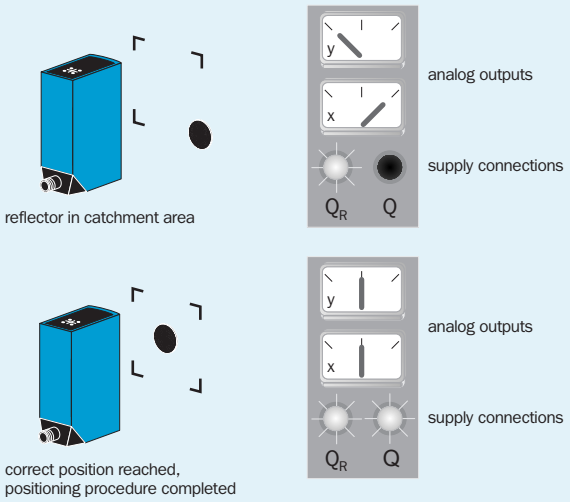
Operating Principle

A new technological approach, a two-dimensional reception array, makes precise positioning possible in x and y axes. The device operates according to the autocollimation principle. The light emitted by the DMP is sent back by a reflector and displayed on the reception array. The position of the reflector is determined from this reflector image. The concentration of the reflected light is focused in the middle of the reception array by corresponding movement of the handling unit. This process results in the desired precise positioning, and the loads can then be transported.

The central control unit pre-positions the handling unit in the catchment area (visible area) of the DMP, where the reflector is detected. After the rough positioning, the DMP can be used for controlling the drives for the precise positioning until the final position is reached. Two analog ouputs, one each for the x and y axes, and two supply connections (Q_R “Reflector detected” and Q “Correct position”) are included. The analog outputs continually report the relative distance to the center point of the reception array.

The supply connection Q_R switches on as soon as the reflector is in the catchment area (visible area)of the DMP (➜ “Reflector detected”).

The supply connection Q switches on as soon as the reflector is displayed in the center of the reception array (➜ “Correct position”).



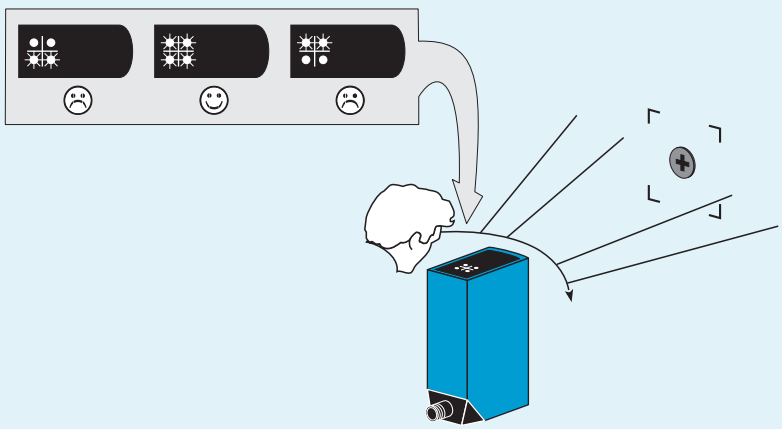
Mounting/Setting

Make sure that the specified reflector type is used for the respective range.

- If the light from the reflector overshoots the two-dimensional reception array, it is no longer possible to position precisely, because the complete reception component is lit. This makes determination of the light focal point impossible.
- If the reception array is not illuminated sufficiently, the light focal point cannot be determined and consequently there cannot be any precise positioning.

Mounting the reflectors on fixed reference points

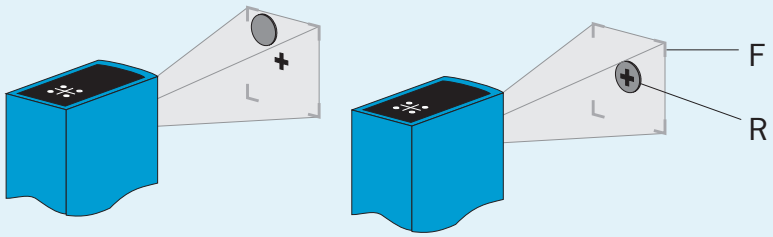
- Mounting of the DMP on the movable unit, which is to be positioned precisely.
- Mounting vertically or horizontally to the narrow side of the device is possible. The scanning angle may be a maximum of ± 10° in all axes vertical to the reflector.
- Mount the DMP on the movable unit, so that the reflector is in the catchment area of the DMP after rough positioning.
- The control lamps can be used for aligning the sensor. When rough positioning is reached, at least one control lamp must light. Sway the sensor in a horizontal and vertical direction until all four control lamps light. When all four control lamps light, the final position has been reached and the precise positioning has been completed.

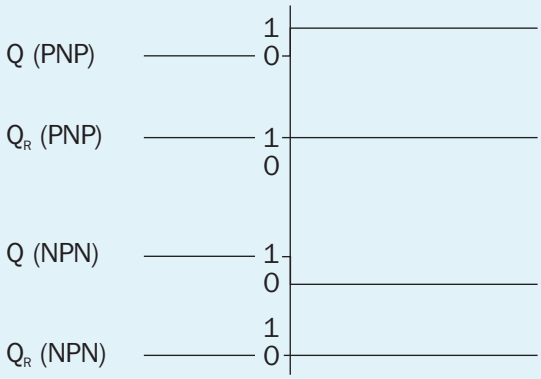


- No special settings or programming of the DMP is required. The DMP Position Finder must only be aimed at the reflector, and then it is ready to operate. When operation of the DMP is started, all four control lamps light for a brief time (➜ function test).

Switching Performance

DMP2-P11111/ DMP2-N11111

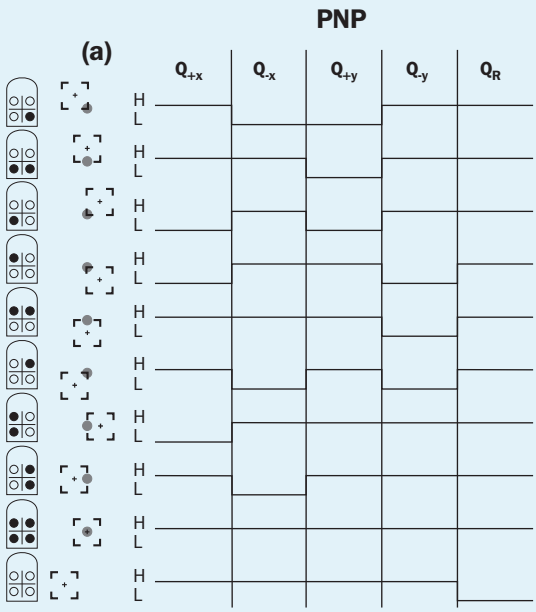




F = Catchment area
R = Reflector
Q = "Correct position"
Q_R = "Reflector detected"

Truth Table

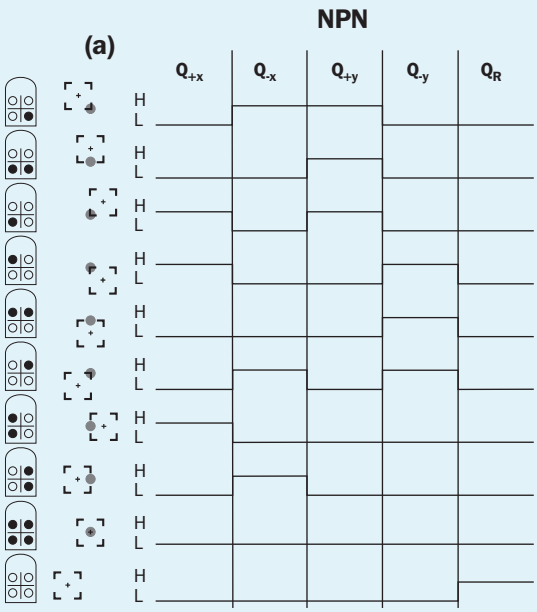
DMP2-P21111



(a) Position of the light spot on the reflector

Truth Table

DMP2-N21111



(a) Position of the light spot on the reflector

Caution: When you use the DMP2-N21111 as a PFK substitute device and the same logic is required, the supply connections Q_{-Y} and Q_{+Y} must be switched!

Summary

As shown in the application examples, the DMP Position Finder can be used where accurate positioning of storage and retrieval units are required and where the effects of prevailing site conditions need to be compensated for.

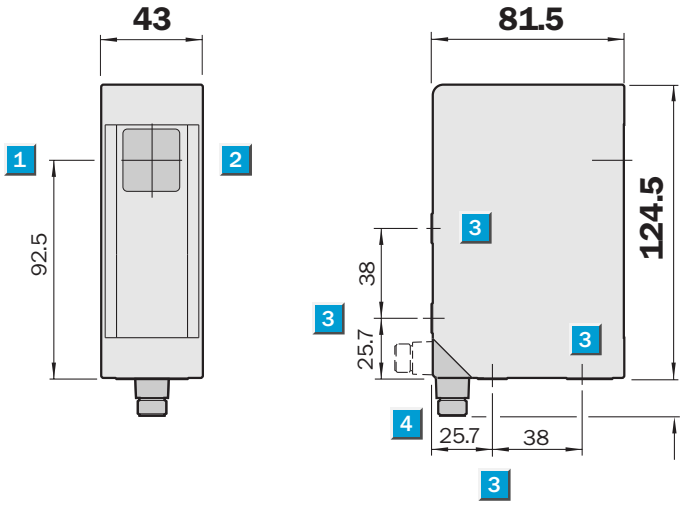
The use of the DMP Position Finder after rough positioning of the movable unit compensates for these effects and optimizes costs and material use in the construction of storage and materials handling systems.

Scanning range
200 … 2000 mm

Position finder

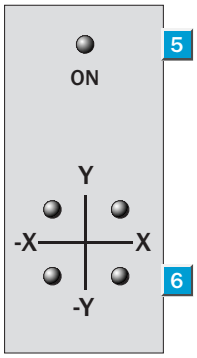
- Five switching outputs
- Integrated software
- Simple operation

Dimension illustration



Setting options

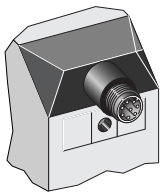
DMP 2-P21111
DMP 2-N21111



1 Middle of the optic axis
2 Receiver
3 Thread borehole M6, 8 mm deep
4 Connection plug M12, 8pin, 90° rotatable
5 Monitoring area
6 Alignment aid

Connection type

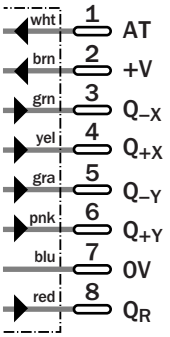
DMP 2-P21111
DMP 2-N21111



Accessories

Cable receptacle
Reflectors

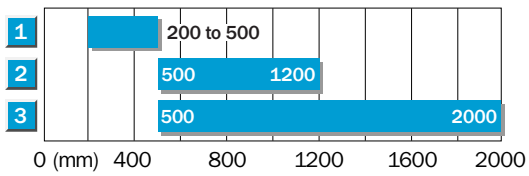
8pin, M12



Technical data	DMP 2	-P 21111	-N 21111
Scanning range	200 to 2000 mm (depending on reflector)	■	■
Repetition accuracy RW	0.15 mm (at 300 mm RW)	■	■
Scanning angle	± 10° in all axis vertical to the reflector (PL 22, PL 50 A, PL 80 A)	■	■
Light sender [1], Light source	LED, visible red light	■	■
Supply voltage V_S [2]	18 to 30 V DC	■	■
Ripple [3]	< 5 V_{PP}	■	■
Current consumption [4]	< 250 mA	■	■
Switching outputs	PNP: HIGH = V_S – ≤ 2 V / LOW = 0 V	■	
	NPN: HIGH = V_S / LOW ≤ 2 V		■
Operating mode	Permanent or synchronized	■	■
	can be selected		
Blanking input AT			
Blanked (triggered)	PNP: > 18 V to < V_S max.	■	
	NPN: 0 V to V_S (≥ 18 V)		■
Free-running	PNP: < 2 V or unconnected	■	
	NPN: V_S – (≤ 2 V) or unconnected		■
Output current I_A max.	100 mA, short circuit protected	■	■
Switching frequency [5]	250/s	■	■
Response time [6]	3 ms	■	■
Connection type	M12 plug, 8pin	■	■
VDE protection class [7]	⧈	■	■
Circuit protection	A, B, C	■	■
Enclosure rating	IP 67	■	■
Ambient temperature [8]	Operating –25 to +55 °C	■	■
	Storage –25 to +75 °C	■	■
Shock resistance	IEC 68	■	■
Weight	approx. 990 g	■	■
Housing material	Zinc	■	■

1) Average service life 100 000 h (at T_U = 25 °C)
2) Limit values (reverse-polarity protected)
3) Must be within V_S tolerances
4) Without load
5) With light/dark ratio 1 : 1, no time delay
6) With resistive load
7) Withstand voltage 50 V DC
8) Do not distort cable below 0 °C

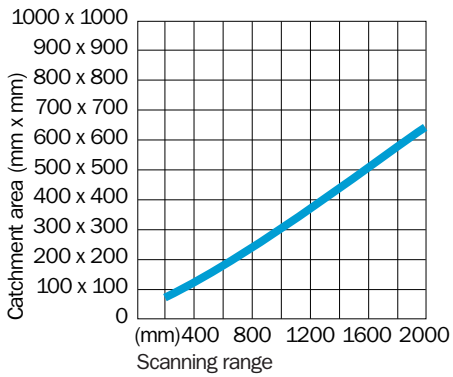
Scanning range

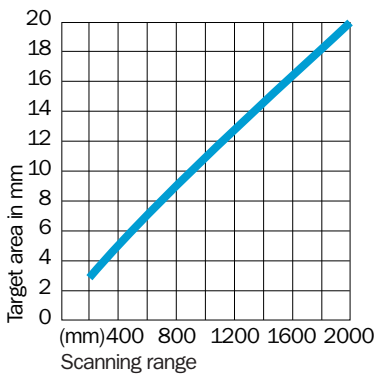


1 Scanning range on reflector PL 22
2 Scanning range on reflector PL 50 A
3 Scanning range on reflector PL 80 A

Ordering information

Type	Order no.
DMP 2-P21111	1 016 237
DMP 2-N21111	1 016 238



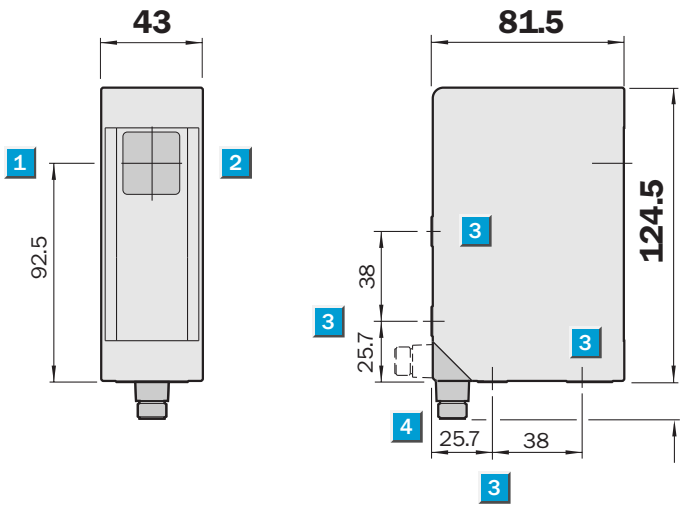


Scanning range
200 … 2000 mm

Position finder

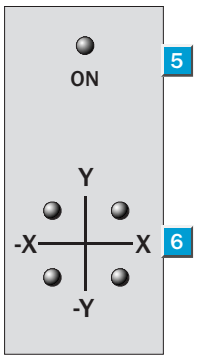
- Two analog outputs (for x- and y-direction)
- Two switching outputs
- Integrated software
- Simple operation

Dimension illustration



Setting options

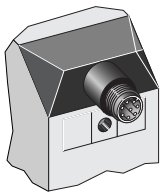
DMP 2-P11111
DMP 2-N11111



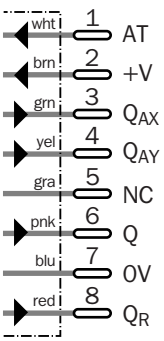
1 Middle of the optic axis
2 Receiver
3 Thread borehole M6, 8 mm deep
4 Connection plug M12, 8pin, 90° rotatable
5 Monitoring area
6 Alignment aid

Connection type

DMP 2-P11111
DMP 2-N11111



8pin, M12



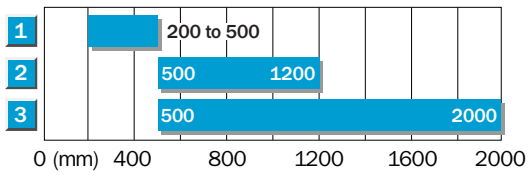
Accessories

Cable receptacle
Reflectors

Technical data	DMP 2	-P 11111	-N 11111
Scanning range	200 to 2000 mm (depending on reflector)	■	■
Repetition accuracy RW	0.15 mm (at 300 mm RW)	■	■
Scanning angle	± 10° in all axis vertical to the reflector (PL 22, PL 50 A, PL 80 A)	■	■
Light sender [1], Light source	LED, visible red light	■	■
Supply voltage V_S [2]	18 to 30 V DC	■	■
Ripple [3]	< 5 V_{PP}	■	■
Current consumption [4]	< 250 mA	■	■
Switching outputs	PNP: HIGH = V_S – ≤ 2 V / LOW = 0 V	■	
	NPN: HIGH = V_S / LOW ≤ 2 V		■
Operating mode	Permanent or synchronized	■	■
	can be selected		
Blanking input AT			
Blanked (triggered)	PNP: > 18 V to < V_S max.	■	
	NPN: 0 V to V_S (≥ 18 V)		■
Free-running	PNP: < 2 V or unconnected	■	
	NPN: V_S – (≤ 2 V) or unconnected		■
Output current I_A max.	100 mA, short circuit protected	■	■
Analog output [5]	4 mA to 20 mA (within catchment area)	■	■
	3 mA (external to the catchment area)	■	■
Switching frequency [6]	250/s	■	■
Response time [7]	3 ms	■	■
Connection type	M12 plug, 8pin	■	■
VDE protection class [8]	⧈	■	■
Circuit protection	A, B, C	■	■
Enclosure rating	IP 67	■	■
Ambient temperature [9]	Operating –25 to +55 °C	■	■
	Storage –25 to +75 °C	■	■
Shock resistance	IEC 68	■	■
Weight	approx. 990 g	■	■
Housing material	Zinc	■	■

1) Average service life 100 000 h (at T_U = 25 °C)
2) Limit values (reverse-polarity protected)
3) Must be within V_S tolerances
4) Without load
5) With $R_{L\,max.}$ = 700 Ω
6) With light/dark ratio 1 : 1, no time delay
7) With resistive load
8) Withstand voltage 50 V DC
9) Do not distort cable below 0 °C

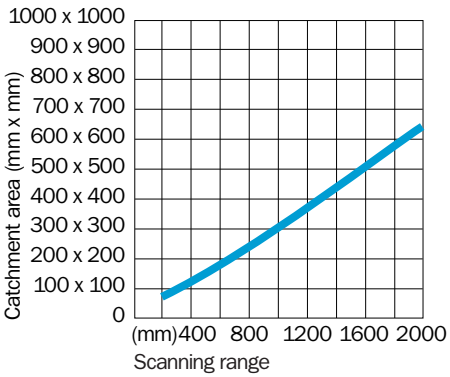
Scanning range

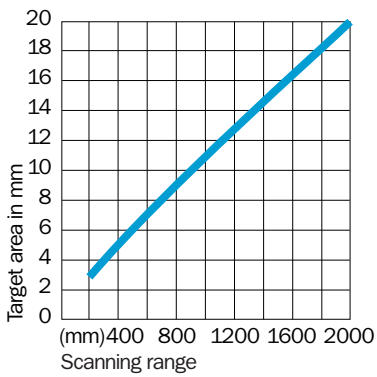


1 Scanning range on reflector PL 22
2 Scanning range on reflector PL 50 A
3 Scanning range on reflector PL 80 A

Ordering information

Type	Order no.
DMP 2-P11111	1 016 235
DMP 2-N11111	1 016 236





Definitions

Catchment area

Visible area of the DMP within which a reflector is detected. Rough positioning is only necessary in this catchment area. The catchment area is dependent on the range and is approx. 105 mm x 105 mm at 300 mm.

Reception array

Two-dimensional receiving component, which is composed of 32 x 32 individual reception components. The focal point of the light distribution is evaluated on this reception array, which enable precise positioning. When the focal point of the light distribution is in the center of the reception array, the correct position has been reached.

Operating range

Distance between the front edge of the lens and the reflector in which the device is ensured under industrial conditions. Dirt contamination of the lens does not influence its operation.

Target area

Area in which the supply connection “Correct position” is active. In this area, the correct position has been reached and the precise positioning has been completed.

Repetition accuracy

Repetitive accuracy of the final position under constant conditions.

Scanning angle

Permissible angle tolerance between sensor and reflector (± 10° in all directions vertical to the reflector).

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